

THE HOMOLOGY OF THE SEXUAL ORGANS ILLUSTRATED BY COMPARATIVE ANATOMY AND PATHOLOGY. By M. WATSON, M.D., *Professor of Anatomy, the Owens College, Manchester.* (PLATES III., IV.)

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HAVING recently been engaged with some investigations into the comparative anatomy of the mammalian generative organs, I have been impressed with the light which, as it seems to me, they throw upon the well-known conclusions of embryologists as to the fundamental similarity of plan upon which the genital organs of the two sexes are built up. I have, therefore, thought that a few remarks upon the subject might not prove altogether uninteresting to the members of this Society. Although not perhaps of any great *practical* value, the study of comparative anatomy, so far as I shall refer to it to-night, is not altogether devoid of interest to the medical practitioner, inasmuch as I hope to be able to show that we find in many of the lower animals structural arrangements which, being normal and constant in them, are only occasionally and abnormally present in the human subject. The investigation, therefore, of these lower and permanent forms is of value, inasmuch as it may throw light upon the rare and with difficulty procurable abnormalities occasionally met with in man. Further, if it be true, as stated by Serres, that "human organo-genesis is a transitory comparative anatomy, as, in its turn, comparative anatomy is a fixed and permanent state of the organo-genesis of man," we shall in the course of these investigations find structural arrangements which, being only evanescent and temporary in the human embryo, are permanently represented in one or other of the lower animal forms, and thus be enabled, so to speak, to check the observations of the embryologist, which, by reason of the minuteness of the structures he investigates and the rapidity of the changes which they undergo, are difficult of completion and not unfrequently admit of subsequent correction. As evidence of the difficulty of these researches, I may merely mention the

fact that not fewer than four distinguished embryologists—Müller, Bischoff, Coste, and Follin—arrived at erroneous conclusions with regard to the persistence and subsequent development of the primary sexual canals of the mammalian embryo, conclusions which were only corrected by the more elaborate investigations of Rathke and of Kobelt.

In attempting to give a concise demonstration of the homologous structures in the two sexes, I shall, in the first place, sketch briefly the arrangement and mode of development of the sexual organs of the human embryo, and having thereby arrived at certain conclusions, shall endeavour to show that these are further substantiated by a reference to the facts of comparative anatomy and of human pathology.

For the sake of clearness of description, we may conveniently distinguish two portions of the generative system in each sex, an *internal* and an *external*, including in the former all those parts which lie *internal to or above* the junction of the sexual and the urinary passages, and in the latter those which lie *external to or below* that point. In the *female* the internal organs thus defined include the ovary, the Fallopian tubes, uterus, and vagina; whilst the external organs comprise the vestibule, clitoris, and glands of Bartholini. In the *male* the testicles with their ducts, the seminal vesicles, and the vesicula prostatica constitute the *internal* organs; whilst the penis, scrotum, and Cowperian glands form the *external* organs of generation.

INTERNAL ORGANS OF GENERATION.

Developmental Sketch of Internal Organs in Man.

At an early period of embryonic life two glandular bodies—the Wolffian bodies, or primordial kidneys—make their appearance within the abdominal cavity. Each of these is provided with a duct—the Wolffian duct,—which, passing backward along the outer side of the corresponding Wolffian body, opens posteriorly into the sac of the allantois. At a somewhat later date two other ducts—the Müllerian—become visible on the anterior surfaces of the Wolffian bodies, with which, however, they are not physiologically connected. These ducts, likewise, when

traeed backward, after coming into close proximity to the Wolffian duets to form the so-called *genital cord*, are seen to open into the allantoic sac, whilst their anterior extremities communicate with the pleuro-peritoneal cavity. As regards the allantois, the observations of embryologists show that its lower or proximal portion undergoes changes which result in the formation of a wide expanded receptacle—the future urinary bladder—and of a narrow contracted segment which ultimately forms the commencement of the urethra in the male, and the whole length of that canal in the female. The termination of the urethra, taken in the stricter sense as signifying the passage by means of which the urine, and the urine alone is expelled, is indicated in both sexes by the junction of the urinary and sexual canals. This junction takes place in the adult male about the middle of the so-called prostatic urethra, and in the adult female at the vestibule. Beyond this point lies the urogenital canal which is common to both urinary and sexual systems, and the development of which we shall consider along with the external organs of generation. All the parts above described are common to embryos of both sexes, so that, up to a certain time, the latter are indistinguishable from one another. From this time onward, however, changes take place which result in the differentiation of the sexual organs. In the *male*, the Wolffian duets persist and ultimately form the vasa deferentia, the vesiculæ seminales being developed as diverticula from their posterior extremities, whilst the Müllerian ducts atrophy, with the exception of a small portion, which persists as the vesicula prostatica or male uterus. In the *female*, on the other hand, the Wolffian duets disappear almost entirely, whilst the Müllerian ducts, previously coalesce in part of their course, remain as the vagina and uterus, their non-coalescent portions persisting as the Fallopian tubes.

From this developmental sketch it will be evident that, as in both sexes the urinary bladder and urethra down to the junction of the latter with the sexual ducts are developed in a similar manner from a similar fundamental structure—the allantois,—they are strictly homologous in both, and that, therefore, the bladder, *plus* the entire urethra of the female is homologous with the bladder, *plus* the upper portion of the prostatic urethra of

the male. In like manner, inasmuch as the Müllerian and Wolffian ducts are fundamental structures common to both sexes, those parts which are developed from each of them respectively must likewise be homologous, and therefore the vagina, uterus, and Fallopian tubes of the female must be regarded as being represented (in part at least) by the vesicula prostatica of the male; whilst the Wolffian ducts, transformed in the male into the vasa deferentia, are represented in the human female by a portion of the apparently functionless organ of Rosenmüller.

From the foregoing sketch it will be seen that in tracing the development of the sexual apparatus we start from an arrangement which is common to both sexes, these latter gradually diverging from each other through the changes which occur in the genital ducts of each. These transformations are indicated in the following table transcribed from the last edition of Quain's *Anatomy*:—

Wolffian Ducts.

Female.		Male.
Tube of the Epoophoron, . . .	1. Upper part, . . .	<div style="display: inline-block; vertical-align: middle;"> <div style="font-size: 2em; vertical-align: middle;">}</div> <div>Convoluted tube of Epididymis.</div> </div>
Ducts of Gaertner, in cow and pig,	2. Lower part, . . .	
		Vas deferens and vesiculæ seminales.

Müllerian Ducts.

Fimbriated extremity of Fallopian tube, . . .	1. Upper extremity, . . .	Hydatid of Morgagni.
Fallopian tubes,	2. Middle part, . . .	<div style="display: inline-block; vertical-align: middle;"> <div style="font-size: 2em; vertical-align: middle;">}</div> <div>Tubular prolongation of vesicula prostatica.</div> </div>
Vagina and uterus, . . .	3. Lower part, . . .	
		Vesicula prostatica.

Now, such being the final destination of those parts, which, as we have seen are common to the human embryo of both sexes at an early period of development, and inasmuch as we find that in respect of other systems the various stages through which these pass in the embryos of the higher animals are, so to speak, rendered fixed and permanent in the adult condition of forms lower in the scale of being, we may, reasoning from analogy, anticipate that the same law will hold good of the generative system, and that the different stages through which the organs composing this system pass in the case of the human embryo shall be represented by permanent arrangements of the corresponding parts in the lower animals. And, as a matter of fact, we

do find that, in so far as this system is concerned, the law above enunciated holds good.

At an early period of embryonic life the digestive, the urinary, and the generative organs of the human embryo have a common opening to the exterior, and this stage remains permanent throughout life in the bird, in which we find a cloaca opening externally and receiving the products of all three systems, but never undergoing a process of differentiation into two distinct channels for the transmission of the genito-urinary and alimentary products, such as we find takes place in the higher mammals. We have seen that in the male human embryo the Müllerian ducts originally present, as in other mammals, almost entirely disappear, except in so far as they contribute to the formation of the vesicula prostatica; and we have now to inquire whether there are any male mammals in which these ducts do *not* atrophy to the same extent as in man, and so represent an intermediate stage between the normal and almost complete disappearance of these in the human male and the large size which they maintain in the human female. If such we can find, we shall thereby confirm the homologies already arrived at from the study of embryology.

Examples of Male Uterus in Animals.

Proceeding with this investigation, we find a number of such animals, and drawings of the parts in question in two of them, the beaver and the ass (figs. 1 and 2), in which they are most strongly pronounced, will be found among our illustrations. The size of the remnant of the Müllerian ducts varies much in different animals, and there does not appear to be any definite law regulating either this or the form which such remnant assumes in the adult. It is not larger in the lower mammals than in the higher, indeed, in the marsupials it is generally absent, there not being, as a rule, the slightest trace of a vesicula prostatica in the male marsupial.¹ Dr Alfred Young² has recently directed attention to its presence in the *Phascogalea koala*, and this observation I have myself confirmed; but the presence of a vesicula prostatica must be regarded as quite exceptional

¹ Leuckart, *Cycl. Anat. and Phys.* art. "Vesicula Prostatica."

² *Journal of Anatomy and Physiology*, vol. xiii. p. 315.

among the marsupials. It is equally absent in many of the Rodentia (mouse, rat, squirrel),¹ whilst in others, as the beaver (fig. 1), it is of large size, and bifurcated at its extremity, presenting in this respect a striking similarity to the double-horned uterus of the opposite sex. Among solipeds and ruminants the vesicula prostatica is generally distinguishable, is sometimes of large size, and may even be bifurcated at its extremity, as in the ass (fig. 2) and goat. Lastly, it is reduced to a minimum in the quadrumana, in which it is not larger than in the human subject. Thus in the lowest and in the highest mammals the vesicula prostatica is small, whilst in the different members of one and the same group it may either attain to considerable dimensions or be altogether absent.

*Transverse Dismemberment of Uterus and Vagina in
the Male.*

We have seen that in the human female the Müllerian ducts unite to form the uterus plus the vagina, the latter representing the lower portion of the coalesced ducts, the former the higher portion. The non-coalescent segments of the ducts remain as the Fallopian tubes. Originally the uterus and vagina form a continuous tube without any difference of structure at different parts, and only in the fifth or sixth month of intra-uterine life do we find that transverse dismemberment taking place which indicates the separation of the future uterus from the future vagina. In the male of the human species this transverse dismemberment seldom occurs, and therefore no argument can be drawn from the normal structure of the vesicula prostatica in him in favour of the correspondence of the latter with the vagina and uterus of the opposite sex; and, *so far as mere structure goes*, we might, in the absence of other considerations, conclude that the vesicula prostatica of the human male represents *either* the uterus *or* the vagina of the female, but not both. When, however, we turn to the lower animals, we find a very cogent argument in favour of the view that the vesicula prostatica of the male represents *both* the uterus and vagina of the opposite sex, not only inasmuch as in many of these, as we have seen, the

¹ Leuckart, *Cycl. Anat. and Phys.* art. "Vesicula Prostatica."

free extremity of the male vesicula prostatica separates into two cornua in precisely the same manner as the uterus of the opposite sex, but also from the fact that sometimes, although rarely, it presents at one point a well-defined constriction which indicates externally the position of an os uteri masculini in the interior. In such cases we have an almost exact reproduction in the male of the permanent condition of the Müllerian ducts in the female. As an example of this arrangement, a drawing of the male organs of a goat (fig. 3)—an animal in which this arrangement appears to be far from uncommon—is here reproduced.

It is to be observed that the view above advocated is not invalidated by those cases in which, as in the human subject, the vesicula prostatica presents no trace of either cornua or of os uteri masculini. It is, in the absence of the latter evidently impossible to determine how much of the structure in question ought to be regarded as uterus and how much as vagina. Morphologically, undoubtedly, its lower part represents the vagina, but where the latter ends and the uterus begins, in the absence of any anatomical or physiological distinction between its parts, it is manifestly impossible to determine. At the same time, it ought to be stated that a consideration of those exceptional cases of the human male, to which attention will hereafter be directed, in which a distinct structural severance between the parts of the vesicula prostatica does take place, tends to show that the normally minute vesicula prostatica represents the vagina alone of the opposite sex, the male uterus when present being represented by a portion of the Müllerian ducts, which, in the majority of cases, altogether atrophies and disappears.

Absence of Transverse Severance of Uterus and Vagina in the Female.

In the majority of female mammals, among which I may mention man, the quadrumana, and the greater number of the carnivora, a well-marked os uteri is present, and seems to define the limits of the uterus and vagina respectively. In some, however, this structural separation is wanting; and, if further proof in favour of the homologies above indicated were needed, it is to be found in the consideration of these cases. In this connection

it is necessary to distinguish two groups of animals—firstly, those in which a structural separation between the uterus and vagina never occurs, the coalesced portions of the ducts of Müller forming uterus (physiological), and uterus *alone*; and, secondly, those in which, although a physiological vagina is formed by the lower ends of the combined Müllerian ducts, there is no distinct line of demarcation between the former and the physiological uterus,—in other words, in which there is no distinct os uteri. The first of these groups is extremely limited, and, so far as I am aware, includes but two species, the *Hyæna crocuta* (fig. 21), and *Elephas Indicus* (fig. 5). In neither of these animals is there any vagina, the united Müllerian ducts forming a single tube without transverse dismemberment, and inasmuch as this tube is adapted to the accommodation of the young, we must regard it as representing the uterus, and the uterus alone.

It is true that Professor Miall¹ is of opinion that, in the Indian elephant there is a distinct os uteri, and consequent separation of the uterus from the vagina; but inasmuch as his drawing (fig. 5) of the female organs of this animal shows that there is no trace of cornua uteri in which, as distinguished from Fallopian tubes, the young could be accommodated, and as that portion of the united Müllerian ducts which lies above the so-called os uteri appears much too limited in extent to permit of the uterine functions being effectively performed during the period of gestation, we are inclined to regard the whole length of the coalesced Müllerian ducts as forming uterine, and uterus alone, rather than as uterus and vagina, the functions of the latter being in this animal delegated to the uro-genital canal. That Professor Miall himself entertains doubts with regard to his interpretation of these facts is evident from his remark, that “it would be interesting to know something of the gravid uterus of the elephant, and in particular to ascertain, by direct observation, in what part of the united sexual ducts the fœtus is lodged, but we have no observations before us which bear upon this point.”

But, whatever may be said with regard to the Indian elephant, there can be no doubt that, in the female of *Hyæna crocuta*, the coalesced portions of the Müllerian ducts form uterus and uterine

¹ *Journal of Anat. and Phys.* vol. xiii. p. 31.

alone, the functional vagina being represented by the uro-genital canal.

Thus, just as on the one hand in the *males* of certain mammals we have, as an exceptional occurrence, a transverse severance of the vesicula prostatica into uterus and vagina, so, on the other hand, we find, as an exceptional occurrence, *females* in which what may be called the normal dismemberment between these organs never manifests itself, the Müllerian ducts uniting to form uterus, and uterus alone. In *Hyaena crocuta* and *Elephas Indicus* this exclusively uterine destination of the Müllerian ducts must be regarded as altogether exceptional, as also the fact that in both the vagina, although without doubt morphologically represented by the lower part of the uterus, is, physiologically speaking, replaced by the uro-genital canal.

As instances, however, of the second and larger group of mammals, comprising those in which the lower portion of the Müllerian ducts persists as a physiological vagina, and yet in which there is no indication of a structural separation between it and the uterus, in other words, in which no os uteri is present, I may mention the common mole (*Talpa europea*) among the Insectivora, the six-banded armadillo (*Dasypus sexcinctus*) and three-toed sloth (*Bradypus tridactylus*) among the Edentata, and the common pig (*Sus scrofa*) among the Pachyderms.¹

I have already shown, upon embryological grounds, that the uterus of the female and the vesicula prostatica of the male are alike formed by the fusion, to a greater or less extent of the two Müllerian ducts. It remains, following out the original plan of this communication, to show that the study of comparative anatomy and of human pathology serves to substantiate the conclusions, in this respect, of the embryologist.

Coalescence of the Müllerian Ducts illustrated by Comparative Anatomy.

An examination of the adult *male* organs throughout the mammalia yields, relatively to the number of species in which these have been accurately examined, but few facts in confirmation of the essentially double nature of the male uterus, for the

¹ Owen, *Anatomy of Vertebrates*.

reason that, in the majority of male mammals, what little remains of each Müllerian duct becomes in the adult so intimately fused with its fellow as to leave almost no trace of the original independence of the two tubes. At the same time, the bifurcated condition of the vesicula prostatica in the ass, beaver, elk, badger, &c., before referred to, furnishes sufficient proof that the vesicula prostatica of the male is essentially a compound structure like the uterms of the female.

Turning, however, to the *female* organs, comparative anatomy furnishes us with abundant evidence confirmatory of embryological conclusions regarding the formation of the uterus and vagina. Among the lower animals we have examples of all grades of coalescence of the Müllerian ducts, from the almost complete separation of them through life, to their almost perfect fusion to form a single structure. Beginning with the lower groups of the mammalia, we find that among the marsupials the ducts of Müller occasionally remain distinct in their entire length throughout life, so that in these animals we have two vaginae and two uteri, the structures of opposite sides being only connected at their openings into the uro-genital canal. Such is the arrangement in the opossum (*Didelphis*), fig. 6. In others, again, as the kangaroos, the Müllerian ducts unite together in the lower part of their course, the two vaginae of these animals being separated by a mesial septum, which however is incomplete. The two uteri, on the other hand, are quite separate. In the biscachia (*Lagostomus*), among rodents, there is a more marked coalescence of the Müllerian ducts, inasmuch as they unite to form a single vagina, whilst the two halves of the uterus are completely separated from one another by a mesial septum which extends as far down as the upper third of the vagina. In this animal there are consequently two ora uteri. In this case there is an advance in degree of the coalescence of the Müllerian ducts over that which occurs in the kangaroos, the mesial septum being confined to the *upper third* of the single vagina. In the hares (*Leporidae*) fig. 4, also we find a complete septum uteri, but in these it stops short at the os uteri, the vagina presenting no trace of its original duplicity. In them also the os uteri is double, the two cornua uteri opening into the single vagina by

¹ Owen, *Proceed. Zool. Soc.* 1839, p. 177.

distinct orifices. A farther stage of coalescence of the Müllerian ducts is seen in the uterus of the majority of the carnivora, as well as in that of the cow (fig. 7), mare, and other animals in which the septum separating the two cornua does not extend as far as the os uteri. In such cases we have a single corpus uteri provided with two distinct cornua. In *Bradypus didactylus*¹ the septum between the two cornua uteri has almost completely disappeared, being confined to the anterior wall of the uterus; whilst in the higher monkeys and in man it has disappeared entirely, and the two uterine horns have completely coalesced to form a single corpus uteri presenting no trace of its original composition.

*Coalescence of the Müllerian Ducts illustrated by
Human Pathology.*

Corresponding to the forms of uterus above referred to in the lower animals we have a series which, occurring as malformations in the human female through imperfection of the normal coalescence of the Müllerian ducts, almost reproduce the former. As parallels to the arrangement met with in the opossum, in which, as we have seen, the ducts remain distinct throughout their course, we have those cases of uterus didelphys which occur occasionally in the human female (fig. 8). This abnormality appears to be constantly associated with others such as render continued existence impossible, and consequently is met with only in the child at birth or in the immature foetus; at least, so far as I can ascertain, we have no record of its occurrence in the adult. But, whilst such cases are met with only in early life, there is another set of cases of much interest occurring in the adult female. I allude to those in which the Müllerian ducts, exhibiting their normal tendency to coalesce, unite so far as those portions which ultimately form the uterus and vagina are concerned, but uniting, retain the mesial septum which, originally separating the two canals, normally disappears. The result is a double uterus and vagina, the halves of which are closely connected together externally, but internally are shut off from one another by the mesial septum above referred to (fig. 9). These

¹ Owen, *Anat. of Vertebrates*, vol. iii. p. 690.

cases exhibit an advance in development when compared with those previously referred to. In the latter the Müllerian ducts remain as distinct structures, and are in no way united, whilst in the former they have, so to speak, obeyed the normal impulse so far as to become united externally, the lumina of the tubes, however, remaining quite distinct. Malformations of this class, occurring in the human female, closely resemble the normal arrangement of the parts above described in the kangaroo among marsupials, and the biscachia among rodents, differing however in the more complete retention of the mesial septum which, as we have seen, divides both uterus and vagina into two completely separated tubes, whilst, in both the animals mentioned, the septum vaginæ is incomplete. An exactly similar arrangement, however, to that which characterises the female organs of biscachia occurs, exceptionally, in the human female. A drawing of it will be found among the illustrations (fig. 10). Another class of cases reported by teratologists as occurring in the human subject exhibit a still greater advance in the direction indicated. In these the septum vaginæ has entirely disappeared, and indications of the original separation of the component halves of the genital organs is limited to the uterus in which a complete septum persists, but does not extend beyond the os uteri. Such cases almost reproduce the arrangement which we have seen to characterise the female organs among the Leporidae, in which there are two distinct ora uteri communicating with altogether distinct cornua, but opening into a single vagina. Cases of this kind, occurring in the human female, appear to be somewhat uncommon, and I have been unable to find a representation of one. The case last referred to, however (fig. 10), approaches very closely to it.

Again, in figs. 11 and 12 we have, occurring as an abnormality in the human female, an arrangement similar to that met with in most of the domestic animals (cow, mare, &c.). In these the septum vaginæ has entirely disappeared, whilst the septum uteri has so far atrophied as to admit of a free communication between its two cornua through the intervention of a distinct corpus uteri which opens into the vagina by a single os. Lastly, in the normal uterus of the human female, the septum uteri has *entirely* disappeared, and a single corpus uteri, without any trace

of cornua, alone remains, and into it the Fallopian tubes enter. This arrangement is reproduced in the higher quadrumana.

*Occasional occurrence of Uterus of Large Size in the
Human Male.*

The facts above enumerated, derived from the study of embryology and of comparative anatomy, appear to leave no doubt as to the vesicula prostatica being the homologue of the uterus. We may, however, farther inquire as to whether the study of human pathology lends any support to this view.

Now, several cases have been put on record in which, in the human male, an organ of large size, and similar in form to the uterus of the opposite sex, occupied the place of the normally diminutive vesicula prostatica. In such cases the Müllerian ducts in the male have, as it were, assumed the mode of growth and consequent form which, under ordinary circumstances, are characteristic of the female.

To examine all the cases which have been put on record would only weary the reader, and I shall therefore content myself with a reference to two of the most marked, one of which is delineated in figs. 13 and 14. The first to which I shall refer is reported by Petit,¹ and occurred in the body of a man aged twenty-two. Sir James Simpson² thus describes it:—"The external organs appear to have presented no deviation from the male type, except in the absence of the testicles from the scrotum, these bodies, with male vasa deferentia, vesiculæ seminales, and a prostate, were found to co-exist with female Fallopian tubes, and an uterus that was attached to the neck of the urinary bladder, and opened into the urethra between this neck and the prostate. The form of this imperfect uterus, M. Petit remarks, merited for it rather the name of a vagina than of an uterus, and it resembled more this organ in the female quadruped than in woman. From the body of the uterus, at 3 inches from its entrance into the urethra, two Fallopian tubes arose. These tubes were perforated, and were $3\frac{1}{2}$ inches long; their abdominal extremities were not loose and provided with fimbriæ, but were attached to a small soft body on each side,

¹ *Hist. de l'Acad. Roy. des Sc.*, 1720, p. 38.

² *Cyc. of Anat.*, art. "Hermaphroditism."

occupying nearly the natural situation of the ovaries, but having the substance or structure of the testicles, and provided with an epididymis and vas deferens. The vasa deferentia were each $7\frac{1}{2}$ inches long, and were attached to two long and rather slender vesiculæ seminales placed alongside of the uterus. The vesiculæ opened into the urethra by two ducts."

The second case, drawings of which will be found among our illustrations (figs. 13 and 14), is recorded by Franque,¹ and almost exactly resembles that above described. It differs, however, in the important particular that the vagina was clearly differentiated from the uterus through the development of a well-marked os uteri. The vasa deferentia, moreover, did not remain pervious to their terminations, and were for a considerable part of their course embedded in the wall of the uterus, exactly as are their homologues, the canals of Gaertner in the uterine wall of the sow.

Sir James Simpson's observations on the first of these cases are of interest from a physiological point of view. He says—"In a note appended to this case, M. Petit states that he had been consulted by a man who rendered blood by the penis regularly every month without pain or any troublesome symptom. Perhaps, adds M. Petit, this man had also a concealed uterus. We have been informed, on credible authority, of two similar cases, the one in a young unmarried man of seventeen years of age, and the other in a person who had been married for several years without his wife having had any children. In both of these cases the discharge was in very considerable quantity, and perfectly regular in its monthly occurrence. Did it consist in a periodical hæmorrhage from the urinary bladder or passages only? or was it, as M. Petit seems to suppose in this instance, of a true menstrual character, and produced by the reproductive organs of the female existing internally, and communicating with the bladder or urethra?"

Persistence of the Wolffian Ducts in Females of the Lower Animals.

Having now seen that in many and indeed in the majority of male mammals, we find a remnant of those sexual ducts—the Müllerian, which only attain their highest anatomical and physio-

¹ Scanzoni's *Berträge zur Geburtskunde*, Band IV. p. 25.

logical development in the female—we have in the next place to inquire whether comparative anatomy throws any light on the persistence of those ducts, the Wolffian, which are only functionally perfect in the adult male. For if we be able to find cases in which in the female along with the functionally perfect Müllerian ducts, there coexist remnants, however, imperfect of the primordial Wolffian ducts, which as we have seen are originally common to both sexes, we shall thereby be enabled, so to speak, to cross check our previous observations in so far as these relate to the homologous parts in the two sexes. Now, such cases are not uncommon among the lower mammals in several species, of which, as for example, some monkeys, the mare, cow, rhinoceros, pig, and certain cetacea, we find the Wolffian ducts persisting throughout life, as the so-called canals of Gaertner (fig. 15). These canals are of very different sizes in different species. In the mare, for instance, they are small, and indeed sometimes indistinguishable; whilst in the cow, and more especially in the pig, they are of large size. They commence above, lying in close relation to the so-called organ of Rosenmüller (which it will be noticed Banks¹ has shown to be the permanent representative in the female of that structure, which in the male forms the epididymis of the testicle), and running down either in the substance of the uterine wall, or in close proximity to it between the layers of the broad ligament of the uterus, terminate by opening into the uro-genital sinus on either side of the urethral aperture. These cases serve to show that just as in certain males we have permanent remnants of truly female canals, so in certain females have we persistence of ducts which belong physiologically to the male.

Occasional occurrence of Vasa deferentia in the Human Female.

In the human female the Wolffian ducts normally disappear, with the exception of a small portion which persists along with the organ of Rosenmüller, and there is therefore in the human subject almost no representative of the canals of Gaertner of the lower animals. But just as we found that, in the perfect human male, we have occasional persistence of the Müllerian ducts, forming a well-marked uterus, so in exceptional cases we find

¹ "On the Wolffian Bodies of the Fetus and their Remains in the Adult."

in the human female persistence of the Wolffian ducts to form vasa deferentia. Such cases, however, are extremely rare; indeed, according to Klebs,¹ only two have been put on record. In one of these reported by Realdus Columbus,² the female organs were well developed, but in addition to the two Fallopian tubes, two canals representing the vasa deferentia passed from the ovary down to the large clitoris. In the other, more recently reported by Füst,³ a double-horned uterus was present, and a single vas deferens, which lay in the external wall of the right cornu uteri, passed down as far as the lower end of the incomplete septum vaginæ, and then turned upwards to open close to the os uteri. These cases occurring in the human female, present, with regard to their comparative rarity, an interesting correspondence with what we have seen in the lower animals, in which, although the uterus is all but constantly represented in the male, the canals of Gaertner are by no means so frequently met with in the other sex.

EXTERNAL ORGANS OF GENERATION.

Developmental Sketch of External Organs in Man.

We have already traced the development of the genital canals as far as the junction of these with the urinary tract, and in order to make plain the observations which follow, it is necessary now to follow out the developmental changes which lead up to the formation of the external organs of generation, understanding by these all the parts of the urino-genital apparatus which are situated below or external to the point indicated.

At an early period in the history of the human embryo, the sac of the allantois, which as we have seen receives the genital ducts, communicates with the lower end of the alimentary canal, and both communicate with the exterior by means of a single channel,—the cloaca. This arrangement is persistent throughout life in the members of the class Aves. At a later date the cloaca, through the growth of a transverse partition, becomes separated into two parts,—an anterior, the so-called genital fissure, which

¹ Handbuch, *Der pathologischen Anatomie*, Seite 741.

² *De re Anatomica*, 1559.

³ *Bildungshemmungen des Utero-vaginal-Kanals*, 1868, Seite 71.

forms the outlet of the genito-urinary apparatus, and a posterior, forming the outlet of the alimentary canal. About the same time a projection buds forth from the anterior extremity of the genital fissure, and forms the rudimentary penis or clitoris according to sex, the margins of the fissure simultaneously closing in toward the middle line. From this time forward the external organs of the two sexes previously alike begin to differentiate. In the female the margins of the genital fissure (sexual folds) never coalesce, but form the labia majora, whilst those of the male unite in the middle line to form the scrotum. In a similar manner the genital member of the female remains in an undeveloped condition as the clitoris, its lower or grooved surface remaining permanently open, by reason of the non-coalescence of the margins, which remain distinct as the labia minora and vaginal bulbs; in the male, on the other hand, the genital member enlarges to form the penis, the margins of its inferior grooved surface uniting in the middle line to form the single corpus spongiosum urethrae. In connection with the anterior and now distinct compartment of the cloaca or uro-genital sinus, and close to the junction of the latter with the base of the genital member, two glands are developed in each sex. These are the glands of Bartholini in the female, and those of Cowper in the male. Opening as these glands do close to the base of the genital member, they form landmarks of first-rate importance in the determination of homologous parts of the uro-genital sinus which differs widely in appearance in the two sexes.

From this outline it will be observed, that that portion of the male uro-genital canal which intervenes between the point of entrance of the Wolffian ducts and the Cowperian glands must be homologous with the portion which in the female intervenes between the entrance of the Müllerian ducts and the glands of Bartholini. In other words, the short and wide vestibule of the human female must be homologous with the elongated and narrow lower half of the prostatic, *plus* the membranous urethra of the male. Similarly the genital members of the two sexes are strictly homologous, differing only in size, and inasmuch as the margins of the lower or grooved surface remain apart in the female to form the vaginal bulbs (fig. 16), whilst in the male they coalesce in the middle line, and complete the spongy portion of

the urethra. The spongy portion of the urethra of the human male has therefore no representative in the human female. Finally, the labia majora are evidently homologous with the two halves of the serotum.

The following table will make these homologies plain:—

Female.		<i>Sinus uro-genitalis.</i>	Male.
Female urethra,.....	{	Upper part of urinary pedicle,.....	Upper portion of prostatic urethra.
Vestibule,.....	{	Lower part,.....	Lower part of prostatic and membranous urethra.
Glands of Bartholini,.....	{	Blastema,.....	Glands of Cowper.
Crura and corpus clitoridis,	{	Corpora cavernosa,...	Crura and corpus penis.
Glans clitoridis and vaginal bulbs,.....	{	Corpora spongiosa,...	Glans penis and corpus spongiosum urethræ.
Labia majora,	{	Genital ridges,.....	Scrotum and raphé.

Now, just as we have seen that the conclusions arrived at by embryologists, with regard to the homologies of the internal genital organs of the two sexes, are borne out by the study of comparative anatomy and of pathology, so we shall see that the same observation may be made respecting the external organs of generation.

Comparative Anatomy of the External Male Organs.

Embryological investigation has shown us that the non-coalescent vaginal bulbs of the human female are represented by the corpus spongiosum of the human male. As farther illustrating the correctness of this view, I may adduce the cases of some few male mammals, in which the corpus spongiosum urethræ exhibits a tendency to retain its original condition; in other words, to remain as two distinct and separate halves for a greater or less part of its extent, in the same way as the homologous vaginal bulbs of the other sex persist as distinct structures. Examples of this arrangement are not uncommon among the marsupials. In some of these the corpus spongiosum splits posteriorly into two parts, thus giving rise to a double urethral bulb, whilst anteriorly it also separates into two portions, producing bifidity of the glans penis. No more powerful argument could be adduced in support of the accuracy of Kobelt's¹ views regarding the homology of the corpus spongiosum with the vaginal bulbs. The arrangement just described is met with in

¹ *Wollust-organe.*

the multiparous marsupials, such as the koala (fig. 17), opossums, and phalangers; whilst in the uniparous genera, such as the kangaroo, the corpus spongiosum exhibits a closer approach to the ordinary arrangement, the glans penis being single, whilst the bulb of the urethra remains double, as in the members of the multiparous section of these animals.

Homologies of the External Genital Organs shown by Abnormal Arrangements in the Human Male.

In the human subject the similarity in structural plan upon which the genital member of the two sexes is built up, is beautifully shown by certain cases of hypospadias, in which the two halves of the corpus spongiosum never unite in the middle line, thus giving rise to an appearance of the male sexual organs so closely simulating that of the female parts, that many cases of hermaphroditism have been described, which must now be removed from that category, seeing that they are simply examples of malformation of the male genital member, and present no trace of the co-existence of the latter with true female organs. Still more remarkable proof, however, of this fundamental community of structural plan in the two sexes, is derived from the consideration of those cases of so-called transverse hermaphroditism occurring in the human being, in which the external organs are arranged exactly as in the normal female, whilst the internal organs are as distinctly those of the other sex. Cases of this kind are far from common, but several have been put on record. The case of Maria Arsano (fig. 18) is one of the most perfect. In him (her?) the external organs were those of the perfect female, the labia, clitoris, os vaginæ, and vulva all being normal. The vagina was only two inches in length, and ended in a blind extremity or cul-de-sac. There was no trace of uterus, broad ligaments, or Fallopian tubes. "The internal organs of reproduction were, on the other hand, completely male. The two testicles were situated in the region of the pubis, and were scarcely clear of the inguinal rings. They were of the usual ovoid figure, and natural in size. They had internally the structure of the tubuli seminiferi, but it was not well developed. The epididymes of the testes were also of the usual vermiform figure, and the corresponding vasa deferentia coursed towards their vesiculæ

seminales, and terminated in an attenuated membranous expansion without any external aperture or ducti ejaculatorii. The vesiculæ seminales were placed between the urinary bladder and rectum; they were smaller and more shrunk than in the adult male, though certainly they preserved their naturally oblong form. The internal hollow or tubular structure was indistinct. The prostate gland was not present.”¹ Cases such as that just described, which the possession of the *essential* organs of generation prove to be males, demonstrate conclusively that, morphologically speaking, the two halves of the corpus spongiosum urethræ and the vaginal bulbs are convertible terms. They show, moreover, that the narrow, elongated uro-genital canal of the male may be occasionally transformed into the characteristic vestibule of the female.

Comparative Anatomy of the External Female Organs.

We have seen that, founding upon embryological observations, the vestibule of the human female must be regarded as homologous with the membranous and in part with the prostatic portions of the male urethra; and that in some few instances the male uro-genital canal becomes so modified in form as to be indistinguishable from that of the other sex. Reversing the process, I shall now adduce some instances in which comparative anatomy shows that the for the most part short and wide uro-genital canal of the female becomes modified so as to present an approach to what may be called the normally elongated form of the latter in the male mammal. In this comparison, the points of entrance of the Wolffian and Cowperian ducts into the uro-genital sinus of the one, and of the Müllerian and Bartholinian ducts into that of the other sex, serve to guide us as to the corresponding segment of the canal in each. In the human female the uro-genital canal (vestibule) does not measure more than one inch in depth, whilst the length of the vagina is about six inches. In the females of several mammals, however, the uro-genital canal is proportionally much longer than in the human female, and presents an approach to the tubular form of the corresponding structure of the other sex. In the cow and giraffe it is elongated to one-fourth the

¹ Simpson, *Cyc. of Anat.* art. “Hermaphroditism.”

the length of the vagina, in the lemurs to one-third the length of that tube, whilst in the platyrrhine group of monkeys the length of the uro-genital canal equals that of the vagina.¹ In the higher or catarrhine monkeys, on the contrary, the canal is always shorter than the vagina, indicating in this respect an approach to the relative proportions of these parts in the human female.

Passing now to the modifications undergone by that portion of the female uro-genital canal which lies beyond the points of entrance of the ducts of Bartholini, we find that whereas in the human female that canal is not at all prolonged forward in relation to the clitoris, in several of the lower mammals, on the other hand, a certain relation does obtain between the clitoris and the uro-genital canal, in whole or in part. Such cases exhibit a tendency on the part of the female organs to approximate to the usual arrangement of those of the male. The relation in question is closer in some mammals than in others. In some, for instance the *Tupaia*¹ among the insectivores, and the *Capybara*¹ among the rodents, the clitoris is of considerable size, and is grooved along its under surface to accommodate the upper wall of the urethra, which manifests, so to speak, a *tendency* to open at the point of the clitoris much as it does in the penis of the other sex. In others again, among which I may mention *Arvicola*, *Lagostomus*, and *Bathyergus*¹ among rodents, in the common mole among the insectivores, and in certain lemurs (*Stenops*),² fig. 19, the groove on the under surface of the elongated clitoris is converted by the coalescence of its margins (much as takes place in the male embryo), into a canal, and the *urethra* is thereby prolonged forward to the extremity of the clitoris. In these instances, however, only a portion of the uro-genital canal, namely the urethra (for, morphologically speaking, so much of the female urethra as lies in relation with the clitoris must be regarded as forming a portion of the uro-genital canal), is contained within the clitoris. In one at least of the lower animals, however, the female spotted hyæna (*Hyæna crocuta*), fig. 21, the entire uro-genital canal beyond the entrance to the ducts of Bartholini is prolonged forward to the extremity of the clitoris, and terminates in a manner precisely similar to that of the uro-genital canal

¹ Owen, *Anat. of Vertebrates*.

² *Cyc. of Anat.* art. "Quadrumana."

(urethra) of the male. The close resemblance which this arrangement of the female uro-genital canal bears to the spongy portion of the male urethra, will be evident from a reference to the accompanying drawings of the corresponding parts in the two sexes (figs. 20 and 21).

Parallel Arrangements in the Human Female.

As parallels to these remarkable arrangements in the females of some of the lower mammals, I may adduce certain exceptional cases in which, in the human female, the uro-genital canal presents modifications in form which indicates an approach to that which is usually characteristic of the male. In certain cases in which in the human female the clitoris is abnormally elongated, notably in one contained in the Museum of the Liverpool School of Medicine,¹ that organ presents a well-marked groove on its under surface, extending forward from the orifice of the urethra, and forming, as it were, the roof of an incomplete uro-genital canal exactly as in the *Capybara*. In another case, reported by Arnaud,² in which the clitoris measured 2 inches 9 lines in length, the urethra perforated that organ for a short distance posteriorly, thus indicating a tendency to that more complete separation of the urethra from the uro-genital canal by inclusion of the former within the clitoris, which we have seen to be the normal arrangement in certain species of lemurs. A still more complete, although not perfect parallel to the complete tunnelling of the clitoris by the urethra in the lemurs in the human subject is recognisable in the well-known case of Marie Lefort.³ In her the clitoris was 27 centimetres in length. "The glans was imperforate, and invested by a mobile prepuce. The body of the clitoris was furnished inferiorly with an imperfect canal, which was pierced along its under surface and middle line by five small holes capable of admitting a small stylet, and one or more similar apertures seemed to exist in it after it reached backwards within the vagina."⁴ Through this

¹ For an account of this case see *Liverpool and Manchester Surg. Reports*.

² *Dissertation sur les Hermaphrodites*, p. 265, plate x.

³ Beclard, *Bulletins de la Faculté*, 1815, p. 273.

⁴ Simpson, *Cyc. of Anat.*, art. "Hermaphroditism."

canal the urine was in part passed. The more complete perforation of the clitoris in this case by the urethra exhibits a closer resemblance to the normal lemurine arrangement above described than any of the others before mentioned. A parallel even to the unique arrangement above described in *Hyæna crocuta* is also met with in the human female, but to this I shall refer in the paragraph devoted to the consideration of the genital organs of that animal.

Comparative Anatomy of the Clitoris.

The clitoris in the majority of the lower animals is relatively much larger than in the human female. In some, indeed, among which I may mention certain quadrumana, and more especially the lemurs of the genus *Stenops* and the spider monkeys (*Ateles*) it attains altogether disproportionate dimensions. In the former, as we have seen, the urethra tunnels the clitoris; whilst in the latter the clitoris actually equals in size the penis of the male, and is deeply grooved along its under surface, the margins of the groove being so closely in contact as almost to form a canal. The vagina and urethra open at its base. The component parts of the clitoris in these as in other mammals are the two corpora cavernosa, which in the species referred to accurately correspond, both in size and form, to the homologous structures in the opposite sex, and thus afford an additional argument in favour of the fundamental correspondence between the penis and clitoris. An additional argument in favour of the correspondence is furnished by those animals, such as the common seal (*Phoca vitulina*), in which a distinct ossification is developed in the corresponding portion of the genital member of each sex.

Parallel Arrangements in the Human Female.

Cases in which the clitoris of the human female equals in size that of the male organ are so numerous that I need not particularise them. Indeed, an elongated and pendulous clitoris appears to be far from an abnormal arrangement among the women belonging to certain African tribes. Even in the European female cases are on record in which the clitoris has attained the extraordinary length of 7 inches.

Female Organs of Hyæna crocuta.

Striking as are these different modifications, alike in man and in the lower mammals, in the form of the genital passages of the two sexes, as indicating the fundamental similarity in plan upon which these organs are built up, there is yet one animal, the spotted hyæna (*H. crocuta*), in which the resemblance between the male and female organs is even greater than in any of the cases above referred to. So closely, indeed, do the external female organs of this animal resemble those of the male that the difficulty of distinguishing between the sexes has given rise to the ascription of hermaphroditism to the species from the days of Aristotle¹ to the present time. The organs of both sexes I have described elsewhere² at length, and shall now only refer to their most salient points. In the male, fig. 20, the internal organs, consisting of the testicles and vasa differentia, are arranged much as usual, the latter opening into the urethra close to the vesicula prostatica. From this point the uro-genital canal (urethra) is prolonged forward to the extremity of the penis in the usual manner. It is divisible into two portions, an intra-pelvic or membranous and an extra-pelvic or spongy portion, the point of junction of these parts being indicated by the entrance of the ducts of two large Cowperian glands. The penis, as in other mammals, is composed of two corpora cavernosa and a single corpus spongiosum. The scrotum resembles that of the true cats, being non-pendulous, and situated immediately below the anal aperture.

Passing now to the examination of the female organs of *Hyæna crocuta*, fig. 21, we find that they present a similarity to those of the male, which, viewed as a normal arrangement, appears to be altogether unique among mammals. The *internal* genital canals as above defined consist of the Fallopian tubes and uterus. The former present no deviation from what may be termed the normal mammalian arrangement. The latter, on the contrary, differs essentially from this, inasmuch as the os uteri, instead of opening into a separate vagina, communicates directly with the uro-genital canal. The vagina is therefore entirely wanting

¹ *Historia Animalium*, vi. 32.

² *Proc. Zool Soc.*, 1877 and 1878.

in this animal, the Mullerian ducts by their junction forming uterus and uterus alone. The *external* female genital organs likewise differ materially from the mammalian type, inasmuch as they present an almost exact counterpart to those of the male. As in the latter, the uro-genital canal of the female is elongated and tubular in form, and is divisible into two portions, an intra-pelvic and an extra-pelvic. Into the commencement of the intra-pelvic segment of the uro-genital canal of the male there opens a minute vesicula prostatica which, inasmuch as the vagina is totally absent in the female, must be regarded as homologous with the uterus, and with the uterus alone, of the latter; in a similar manner the uterus of the female opens into the uro-genital canal of that sex. As in the *male* the junction of the intra- and extra-pelvic portions of the urethra is indicated by the entrance of the ducts of two Cowperian glands, so in the *female* is it indicated by the entrance of the ducts of Bartholinian glands of the same size and form as the homologous structures in the male. As in the *male* the urethra passes forward to terminate at the extremity of the penis, so in the *female* the uro-genital canal, in the absence of a vulva, passes forward to open at the extremity of the clitoris. As in the *male* there is an elongated pendulous penis provided with a movable prepuce, so in the *female* there is a clitoris of the same size and form, provided in a similar manner with a well-developed and movable prepuce. As in the *male* there is a well-marked scrotum, so a similar structure occupying a similar position is found in the *female*. The erectile organ is of the same size, and constructed upon the same plan in both sexes, the only difference being that in the female the uro-genital canal is not surrounded by the erectile tissue of the corpus spongiosum as is the case in the male, this difference being due to the fact that in the latter the essentially bi-lateral spongy bodies have coalesced in the middle line, whilst in the female they remain distinct throughout life, and do not surround the sexual canal. In the *female*, moreover, and associated with this arrangement, there is a complete absence of the elevator urethræ and bulbo cavernosi muscles, both of which are well developed in the male.

Extraordinary and aberrant from what must be regarded as the typical arrangement of the female mammalian organs as that of

Hyæna crocuta undoubtedly is, I am nevertheless able to adduce certain cases which, occurring as abnormalities in the human female, almost exactly reproduce it. Such cases, as may be readily imagined, are extremely rare, and so far as I can ascertain only three such have been put on record. One of these,¹ occurring in a child at birth, was combined with other malformations of such a nature as to lead to some dubiety as to the significance of the parts affected; whilst in another,² occurring in the body of an adult aged 45, in addition to the essentially female internal organs, there were superadded the lower ends of the male vasa differentia, together with rudimentary seminal vesicles. I shall, therefore, confine my observations to the third case, in which, as along with purely female internal organs there co-existed external organs as characteristically those of the male, we find the most perfect parallel to the arrangement above described in the female *Hyæna crocuta*.

The case, fig. 22, occurred in the body of an individual named Valmont,³ who died in Paris at the age of 36. He had been married as a male. The *internal* organs consisted of two Fallopian tubes arranged as usual, of a uterus resembling much that of the ordinary female, and of a vagina which opened into the membranous (?) part of the urethra. The *external* organs consisted of an elongated uro-genital canal, which extended from the junction of the vagina with the urethra to the extremity of the penis, exactly as in the normal male, its intra-pelvic portion being provided with prostate and Cowperian glands. The extra-pelvic or spongy portion exactly resembled the male urethra, inasmuch as it passed through a normally formed penis composed of corpora cavernosa and corpus spongiosum, and provided with all the muscles usually found in the male perineum. The penis was of medium size, and furnished with a movable prepuce. There was no trace of a vulva. A well-developed scrotum was likewise present. A comparison of fig. 21 with fig. 22 will show at once how closely the parts of this human female reproduce those of the female hyæna. The points of difference between them are few and unimportant. They consist

¹ Eschricht, *Müller's Archiv für Anatomie*, 1836.

² *Il Morgagni*, 1865, p. 151.

³ See *Journal universel et hebdomadaire de Médecine*, 1833, p. 467.

in—first, the presence of a prostate gland in the woman which is absent in the hyæna; secondly, in the presence in the former of a distinct os uteri and consequent differentiation of the two portions of the Mullerian ducts which form respectively uterus and vagina; and, lastly, in the complete coalescence of the halves of the corpus spongiosum and concomitant development of the bulbo-cavernosi muscle in the body of Valmont, whereas in the female hyæna the halves of the corpus spongiosum remain separate, and the bulbo-cavernosi muscles are not developed.

We have now traced the development of the generative system in man from the time when its component parts were exactly alike in the two sexes, and when, consequently, the latter could not be distinguished from one another to that in which these organs assume the characters which are usually regarded as distinctive of each. We have, moreover, seen that, in some instances, these distinctive sexual features are never developed, so far as the genital passages are concerned, and this to such an extent that, in certain individuals (*e.g.*, Marie Arsanno, fig. 18), we find associated with *internal* genital passages essentially male in character *external* passages which are as characteristically those of the female. We have seen that the converse also holds good, and that, as in the case of Valmont, fig. 22, along with essentially female *internal* organs, there may co-exist external organs of the type usually regarded as distinctive of the male. Further, we have seen that these abnormalities in the human subject are, so to speak, reproduced as normal arrangements in the case of certain of the lower mammals, in which we find that the male presents features which assimilate it to the female (*e.g.* koala, external organs; beaver, internal organs), whilst, on the other hand, there are certain females (*e.g.* cow, internal organs; hyæna, external organs) which present features in the arrangement of the genital organs which indicate an approach to those of the males of the same species. Taking these facts into consideration, the question arises, What value is to be placed upon the arrangement of the genital passages as a criterion of sex? The answer must be, that the genital passages *per se* afford no such criterion. That this conclusion is not devoid of practical interest is well shown by the views of two distinguished French

writers, MM. Bouillaud and Manec,¹ regarding the sex of the woman Valmout above referred to. With reference to this case, M. Manec says—"If we take a general view of the arrangements which have been pointed out, we see that the malformation in question does not deserve the name of hermaphrodite, seeing that there are only present the organs of a single sex, those of the female. The only difference existing between this individual and a well-formed female is to be found in the fact that the vagina, instead of terminating on the exterior by means of a wide and independent aperture placed between the anus and the meatus urinarius, contracts to a line in diameter and opens into the urethra. The absence of a vulva, and the presence of a well-formed penis, is explained by the excessive development of the labia minora and of the clitoris, the former by their junction having caused the disappearance of the vagina and formed the raphé, whilst the clitoris, developed beyond measure, has acquired all the characters of the penis which, in the normal condition, it only imperfectly represents. It is also in virtue of excess of development that the urethra has acquired the characters of that of the male. Thus, so far there is not a single new organ present in this woman; all those which are present and which might suggest doubts as to the sex are present in a rudimentary condition in the well-formed female. There is therefore only an excess in size of the external genitals, and consequent suppression of the vulva, together with union of the urethra and vagina. The prostate, however, which does not exist in the female, is here, where it is well formed, and embraces as in man the neck of the bladder and the beginning of the urethra. If, then, this organ were essential to the male genitals its presence would embarrass us, and compel us to recognise in this case a commencement of hermaphroditism. . . . The prostate in the male is only an accessory organ secreting a fluid which by its mixture with the sperm facilitates the progress of the latter within the urethra, and its forcible projection beyond that canal. The mixture of the prostatic fluid is not a necessity to the accomplishment of fecundation, seeing that, in several species of mammals, this takes place notwithstanding the absence of the prostate. . . . This fact proves that the prostate cannot be considered as

¹ *Journal universel et hebdomadaire de Médecine*, 1833, pp. 472 and 489.

an essential sexual characteristic, and consequently its presence in a female cannot contribute anything toward giving her the slightest resemblance to the opposite sex. . . . This case confirms de Blainville's ideas of the analogy existing between the organs of the two sexes, and realises the supposition made about fifteen years ago by that learned naturalist, that the only essential difference between the two sexes, consisting in the independence of the genital canal of the female, it would suffice to make of the latter an apparent male to unite the urethra with the vagina."

To this M. Bouillaud replies—"M. Manec seems disposed to place Valmont among the women. He, therefore, does not fear to place himself in opposition to the civil law, to the church, and even to Valmont himself, who had the courage and feeling of manhood to marry a woman. I confess at the same time that there is no law obliging us to believe in the infallibility of the civil law, or even of the church, so far as monstrosities are concerned, and, if with regard to them, the facts being put aside, I had to choose between the opinions of a mayor, a priest, and of M. Manec, I would not long hesitate. But it appears to me very difficult, conforming to the dictates of a sound anatomy, to find in Valmont all the elements of a woman and the true and pure elements of a woman alone. What a woman ! Bon Dieu ! An individual who has not a vulva, who has only the rudiment of a vagina following upon the vesical extremity of the urethra, who possess a penis, a scrotum, a prostate, and Cowperian glands all well-formed ! What man would desire to keep company with a woman so conditioned ? But, says he (Manec), if she was not a woman, Valmont was a man, for it is necessary to place him somewhere and to assign to him some function ? Without doubt, it is necessary to place him somewhere and to assign to him some function. Nevertheless, it is neither that of a woman nor of a man in all its purity. He is a compound of a man and a woman, a kind of *third sex*, a *mongrel* or a *sexual mule*."

This discussion shows more forcibly than any remarks of my own the utter futility of attempting to find in the arrangement of the genital *passages* any feature absolutely distinctive of sex. Neither is there any certain arrangement of the accessory reproductive glands which can be regarded as peculiar to either.

We have seen that the glands of Cowper in the male hyæna exactly repeat those of Bartholini in the female in size, form, and mode of entrance into the uro-genital canal, and that therefore neither of these glands present any peculiarities distinctive of sex. At first sight, indeed, it appears that the presence of the prostate gland is sufficiently distinctive of the male mammal, but further consideration shows that such is not the case. The entire absence of the prostate gland in the males of many species of mammals (elk, red deer, &c.) shows that it is by no means an essential constituent of the male genital organs; whilst, on the other hand, although I am not aware of the existence of any female mammal in which a prostate gland is *constantly* present, yet the mere fact of its occasional occurrence in undoubted females of our own species at once destroys its value as affording an index to the sex of the individual in which it occurs. The gland is not uniformly present in the male mammal, neither is it always absent in the female, and consequently cannot, in any way, be regarded as distinctive of either sex.

We are, therefore, compelled to look elsewhere for a distinctive sexual characteristic. This is to be found in the histological structure of the genital *gland*, and in this *alone*. The presence of a genital gland presenting the structure of the testicle is the *single* distinctive characteristic of the male, just as the possession of an organ displaying the histological characters of the ovary is the *only* certain guide to the determination of the female sex. The late Sir J. Y. Simpson, in his remarkable article on Hermaphroditism, in Todd's *Cyclopædia of Anatomy*, divides hermaphrodites into two classes, *spurious* and *true*. With the former we are not now concerned. The latter group he subdivides into three subordinate sections—(1) *Lateral* hermaphrodites, in which there is a testicle on the one side of the body and an ovary on the other; (2.) *Transverse* hermaphrodites, in which the external organs are those of the male and the internal those of the female, or the reverse; (3.) *Vertical* or *double* hermaphrodites, in which there are present (*a*) Ovaries associated with combined male and female passages, (*b*) Testicles with a similar combination, (*c*) Ovaries *and* testicles co-existing on one or both sides.

A consideration of the facts set forth in the preceding pages

shows that the group of *lateral* hermaphrodites, as above defined, is the only one to which the term *true* can, with propriety, be applied, whilst all the others ought to be included in the much larger section of *spurious* hermaphrodites, with the doubtful exception of subdivision (*c*), which, viewed in the light of embryological research, ought probably to be placed in the category of double monsters.

In conclusion, I have to acknowledge, with many thanks, the kindness of my friend Dr Alfred Young in reducing and adapting the various illustrations which accompany this paper.

EXPLANATION OF PLATE III.

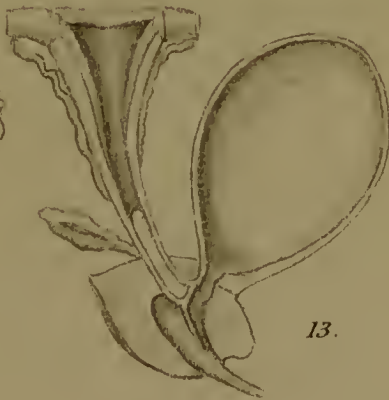
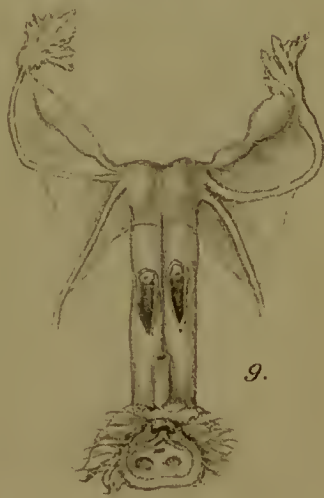
Fig. 1. Bifurcated vesicula prostatica of beaver (Leuckart). Fig. 2. Bifurcated vesicula prostatica of ass (Leuckart). Fig. 3. Vesicula prostatica of goat, showing separation into uterine and vaginal portions (Leuckart). Fig. 4. Female organs of hare (Owen). Fig. 5. Female organs of Indian elephant (Miall). Fig. 6. Female organs of opossum (Owen). Fig. 7. Uterus of cow laid open (Owen). Fig. 8. Double uterus and vagina of child. The two halves are quite separate, as in the opossum. Fig. 9. Double uterus and vagina of human female. The two halves are united (Küssmaul). Fig. 10. Double uterus, with incomplete duplicity of vagina of human female (Küssmaul). Fig. 11. Uterus of human female, showing single corpus uteri and two cornua (Farre). Fig. 12. Another example of the same (Küssmaul). Fig. 13. Large vesicula prostatica of human male resembling the female uterus. The lower portion represents the vagina (Franque).

EXPLANATION OF PLATE IV.

Fig. 14. Another view of Franque's case of large vesicula prostatica. Fig. 15. Uterus of calf, showing the canals of Gaertner on either side (Kobelt). Fig. 16. Lateral view of the erectile structures in human female (Kobelt). Fig. 17. Penis of koala, showing bifidity of bulb and glans penis (Young). Fig. 18. Generative organs of Maria Arsano (Simpson). Fig. 19. Female organs of Stenops, showing perforation of clitoris by urethra (Vrolik). Fig. 20. Male organs of *Hyena crocuta*. Fig. 21. Female organs of *Hyena crocuta*. Fig. 22. Generative organs of Valmont (Bouillaud).

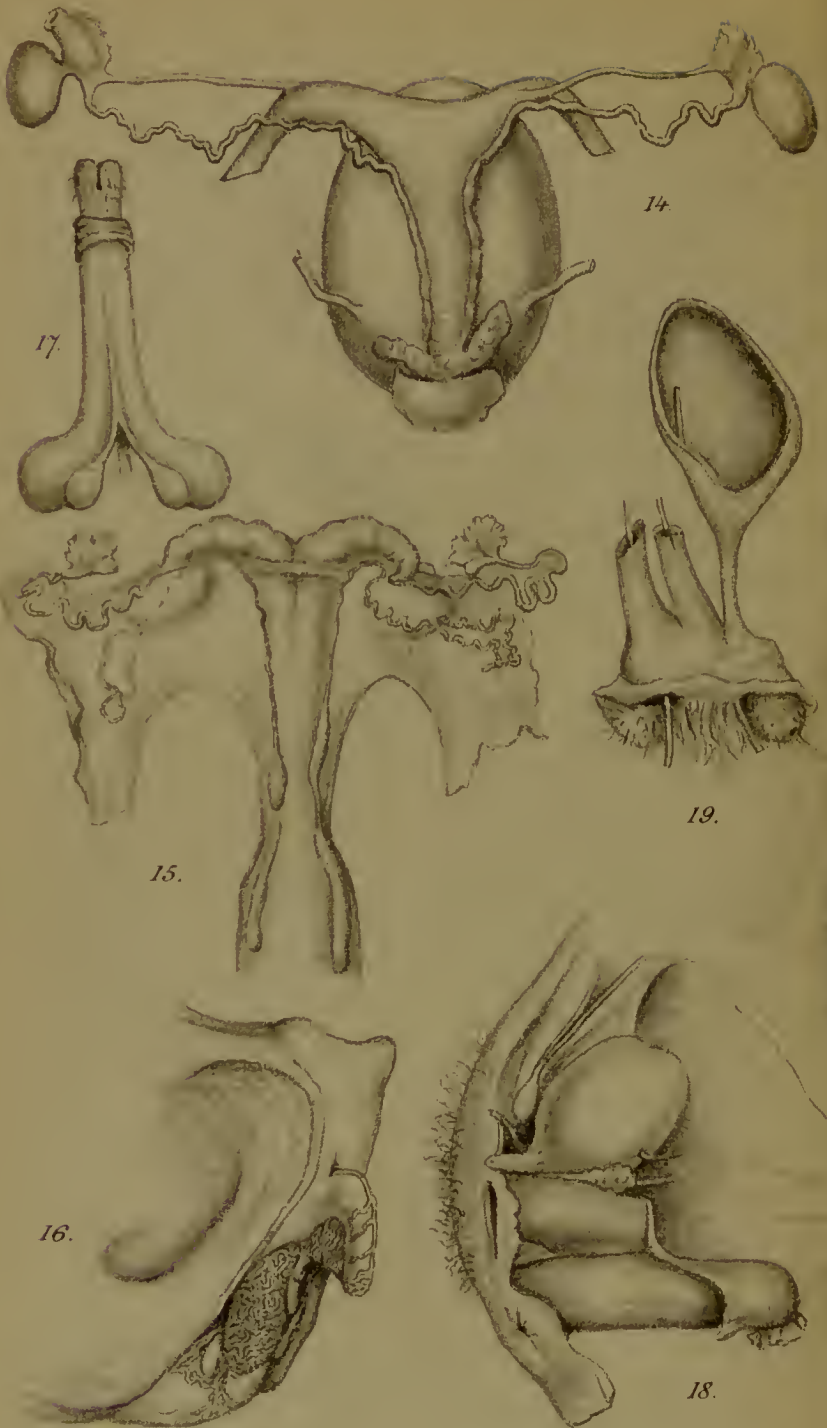


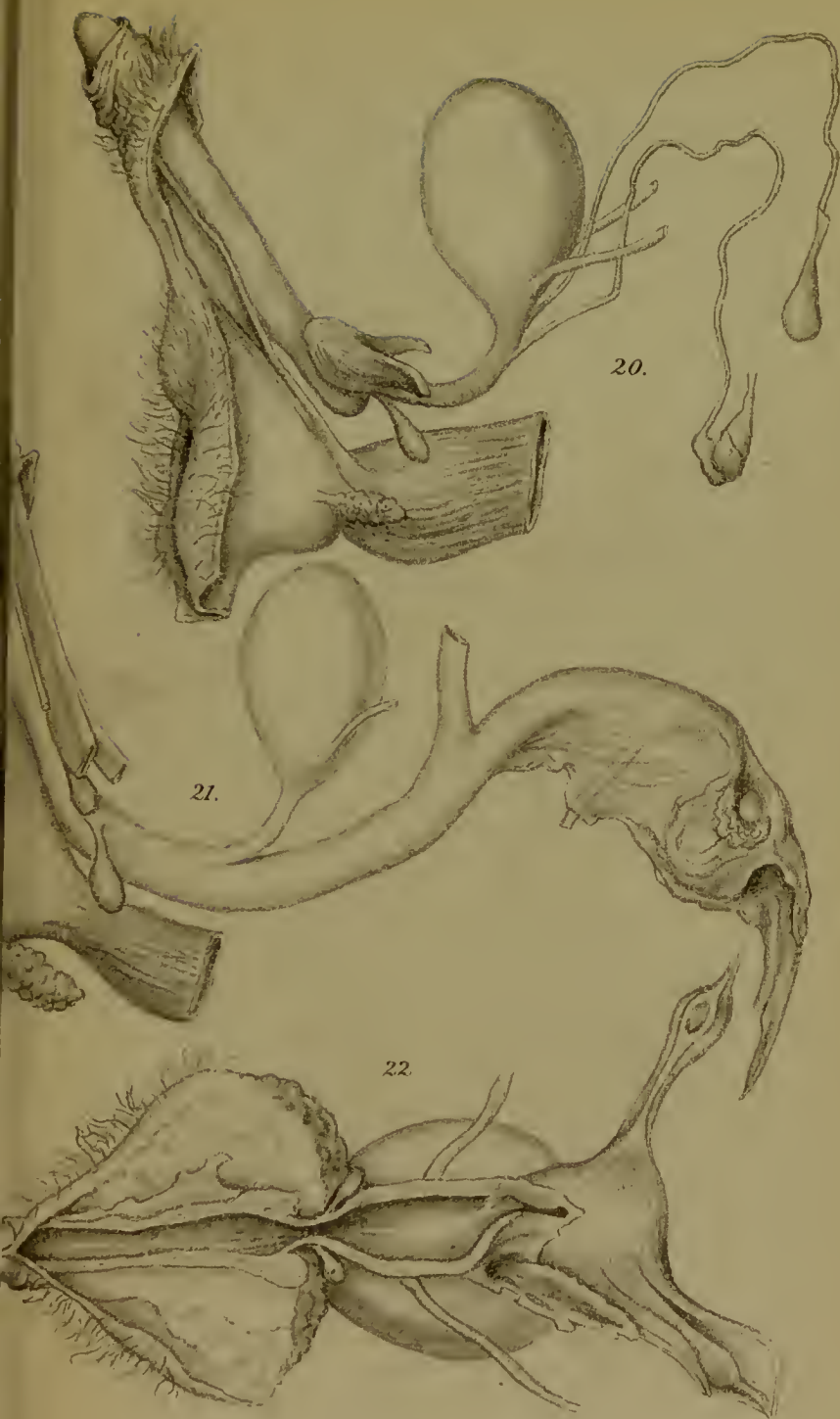




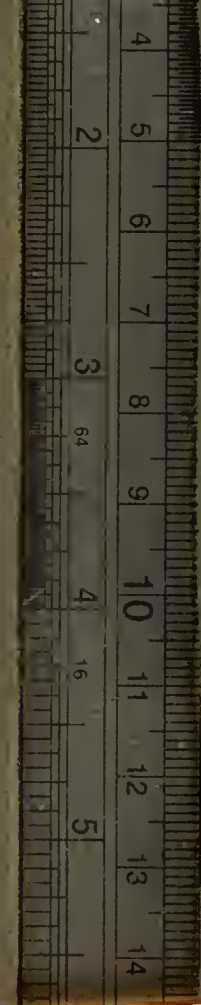












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